

Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN No. 13.

CRANBERRY CULTURE.

BY

WILLIAM SAUNDERS,
SUPERINTENDENT OF GARDENS AND GROUNDS.

PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.

1894.

FARMERS' BULLETINS.

The bulletins of this series may be obtained by applying to the Secretary of Agriculture, Washington, D. C. The following have been previously issued:

Farmers' Bulletin No. 1. The What and Why of Agricultural Experiment Stations. (A brief explanation of the object, origin, and development of the stations, their work in Europe and in the United States, and the operations of the Office of Experiment Stations of the Department of Agriculture.) Prepared by the Office of Experiment Stations. Pp. 16. Issued June, 1889.

Farmers' Bulletin No. 2. The Work of the Agricultural Experiment Stations. (Illustrations of station work in the following lines: Better cows for the dairy; fibrin in milk; bacteria in milk, cream, and butter; silos and silage; alfalfa; and field experiments with fertilizers.) Prepared by the Office of Experiment Stations. Pp. 16. Issued June, 1889.

Farmers' Bulletin No. 3. The Culture of the Sugar Beet. (Treats of the climatic conditions, soils, fertilizers, and cultivation required by the sugar beet, cost of growing, time to harvest, and method of siloing; describes briefly the process of beet-sugar manufacture, and gives statistics of sugar production and consumption.) By H. W. Wiley, Chemist of the Department of Agriculture. Pp. 24. Issued March, 1891.

Farmers' Bulletin No. 4. Fungous Diseases of the Grape and their Treatment. (Describes downy mildew, powdery mildew, black rot, and anthracnose of grapes, and gives instructions for their treatment and estimated cost of remedies.) By B. T. Galloway, chief of the Division of Vegetable Pathology. Pp. 12. Issued March, 1891.

Farmers' Bulletin No. 5. Treatment of Smuts of Oats and Wheat. (Describes the smuts of wheat, oats, and barley, the damage they cause, and the various methods of treatment which have been found useful for their prevention.) Prepared by the Division of Vegetable Pathology. Pp. 8. Issued February, 1892.

Farmers' Bulletin No. 6. Tobacco: Instructions for its Cultivation and Curing. Prepared by John M. Estes, special agent. Pp. 8. Issued February, 1892.

Farmers' Bulletin No. 7. Spraying Fruits for Insect Pests and Fungous Diseases, with a Special Consideration of the Subject in its Relation to the Public Health. Prepared by the Divisions of Entomology and Vegetable Pathology. Pp. 20. Issued April, 1892.

Farmers' Bulletin No. 8. Results of experiments with inoculation for the Prevention of Hog Cholera. By D. E. Salmon, chief of the Bureau of Animal Industry. Pp. 40. Issued May, 1892.

Farmers' Bulletin No. 9. Milk Fermentations and their Relations to Dairying. Prepared in the Office of Experiment Stations. Pp. 24. Issued July, 1892.

Farmers' Bulletin No. 10. The Russian Thistle and other Troublesome Weeds in the Wheat Region of Minnesota and North and South Dakota. Pp. 16. Issued April, 1893.

Farmers' Bulletin No. 11. The Rape Plant: Its History, Culture, and Uses. By Thomas Shaw, professor of agriculture in the Ontario Agriculture College. Pp. 20. Issued June, 1893.

Farmers' Bulletin No. 12. Nostrums for Increasing the Yield of Butter. By Harvey W. Wiley, Chemist of the U. S. Department of Agriculture. Pp. 16. Issued June, 1893.

CRANBERRY CULTURE.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF SUPERINTENDENT OF GARDENS AND GROUNDS,
Washington, D. C., December 9, 1893.

SIR: The manuscript of Farmers' Bulletin No. 13, on the cranberry, is herewith transmitted for publication. The bulletin is mostly compiled from articles published in various annual reports of the Department and from the "Handbook of Experiment Station Work."

Respectfully,

WILLIAM SAUNDERS,
Superintendent of Gardens and Grounds.

Hon. J. STERLING MORTON,
Secretary of Agriculture.

INTRODUCTION.

THE WILD CRANBERRY.

The American cranberry (*Vaccinium macrocarpon*) is found in a wild state in boggy land throughout the northern portions of the United States, in parts of Canada adjacent, as well as in the marshes of the coast and in the glades of the Alleghanies as far south as Virginia and North Carolina. It is also found in South America.

The cranberry is supposed to have been named from the appearance of its bud. Just before expanding into the perfect flower the stem, calyx, and petals resemble the neck, head, and bill of a crane—hence the name "craneberry" or "cranberry."

The plant belongs to the heath family, and is a small hardy shrub with evergreen leaves, and acid edible fruit, varying in color from light dull pink to a dark purple.

WHERE THE CRANBERRY IS GROWN.

The cultivation of the cranberry was commenced in the early part of the present century, but until about forty years ago was conducted on a very limited scale. The first culture was in the vicinity of Cape Cod. The crop of the country is divided into three divisions, namely, the New England, the New Jersey, and the Western. The New England crop includes all raised in the New England States, three-fourths of

which is raised in the vicinity of Cape Cod; the Western crop includes that gathered in Michigan, Wisconsin, Minnesota, Iowa, and northern Ohio and Indiana.

Although the plant is indigenous to both continents and grows wild in many parts of the world, yet the American cranberry is the largest, deepest colored, and the richest flavored that appears in the European markets.

CONDITIONS FAVORABLE TO PRODUCTION.

Wherever the cranberry grows naturally it indicates the conditions most favorable to its production. It chooses locations well supplied with moisture, and a peaty, or sometimes silicious, soil, free from any mixture of clay. Peat is most favorable to luxuriance of the vine, but the presence of silex also, in considerable quantity, is necessary to productiveness and the finest fruit, as it hardens the wood, prevents too vigorous growth of vines, and discourages the growth of weeds.

On pure, deep, black peat the cranberry vine will grow more rapidly than in any other soil. A single crop will perhaps be obtained, and then the vines become abortive. The same is true of vines grown on rich intervals, if the wild grasses are kept out. The vines in such situations are very rank, the uprights being of twice the length they attain in productive bogs; and on comparing the two it will be found that the unproductive vines are soft and flimsy, while the productive ones are hard and stiff. A careful chemical analysis of the two would probably disclose the fact that the productive vine contains more silex in its constituent parts than does the unproductive. That this is true is shown by the touch alone. The productive vines are harsh, and when drawn between the fingers the silex with which they are coated grates the skin.

LIMITS OF SUCCESSFUL CULTIVATION.

The limits between which this fruit may be successfully cultivated are stated by an intelligent observer to be the thirty-ninth and forty-second degrees of latitude; but the limit may be greatly extended southward in the Alleghanian ranges, and at least thirteen degrees northward on the western coast of the continent, owing to the ameliorating influence of ocean currents upon the climate of that coast; and we find that cranberries grow in abundance upon the large island of Kodiak, south of and adjacent to Alaska, and of as good quality as those cultivated upon Cape Cod.

REMUNERATIVE NATURE OF THE CROP.

Unlike most other agricultural productions, cranberry vines, growing upon land adapted to them, require no expenditure for manure and no tilling to keep them in good condition. When once established, they will last for years, yielding good returns as regularly as ordinary

farm crops. These facts, in connection with the high price of the fruit, render cranberry culture a most remunerative business.

It requires a very considerable expenditure of labor and money to start the business, and after that, much patience to reap the reward; but when once a good meadow comes into bearing, he who owns it may congratulate himself upon possessing something that is pleasant to look after, and that is profitable also.

SOIL.

AUTHORITIES REGARDING THE SORT OF SOIL.

Observation shows that the cranberry usually chooses a peaty, or a silicious, moist soil, and continuous success in its cultivation has been achieved upon such soils only. Prof. Agassiz says:

Never use the drift formation in preparing cranberry grounds. Use silicious sand that has been entirely separated from loam by the action of water.

An observant cranberry-grower of New Jersey says:

Experience has proved that for the successful cultivation of this fruit the following are requisites: First, a peat, or muck soil, free from loam or clay; second, clean beach sand for covering the peat; third, a dam and water to overflow the vines when necessary; fourth, thorough drainage.

These conclusions are warranted by the experience of cranberry-growers generally, and while, in very favorable localities as to climate, the winter flooding for the protection of the vines may be omitted, and while it is true that some have succeeded in raising good crops upon pure peat, and also upon sand alone, still these variations from the foregoing rules are at the great risk of the cultivator, and should not be practiced except after careful experiment.

THREE KINDS OF SUITABLE SOIL.

There are three kinds of ground suitable for raising cranberries. The first is what is called "savanna," being low spots of ground with grass or small bushes, and covered with water during the winter and spring, but becoming dry during the summer. These spots have a thin coating of vegetable mold overlying white sand. The second is a mixture of sand and muck to a depth varying from 6 to 10 inches, underlaid with sand and covered with scanty vegetation, the bottom, or subsoil, being hard sand. The third is a deep muck, usually along a stream affording a growth of white cedar, or sometimes maple trees and bushes.

UNSUITABLE SOILS.

It is said that swamps in which the prevailing trees are gum are unsuited to the cranberry. They indicate cold spring water, which is inimical to the growth of this plant; it requires pure water, but not too cold.

The cranberry can not be successfully cultivated on the "drift formation." Hundreds of experiments have been tried, and all have proved to be failures. It is unnecessary to give details; they would fill a volume and be of little practical utility. Prof. Agassiz describes the "drift formation" as being that portion of the earth's surface which was formed by glacial action, and consisting of rocks not in place—that is, loose and not in solid ledges—gravel, clay, and loam. This definition is plain and simple, and any farmer will understand it and be able to distinguish drift as soon as he sees it. In that formation strata of sand are often found, but it usually contains some loam, and it is better to avoid its use. Bogs naturally well adapted to the growth of the cranberry have been ruined by using drift material in preparing them. In some bogs where partly drift and partly alluvium was used, the exact line between the two can be traced by the difference in the growth and appearance of the vine.

THE BEST SORT OF SOIL.

The "alluvial formation" is the only one on which the cranberry can be successfully cultivated. Though this formation includes the most barren and the most fertile soils—the driest and the most damp—yet its character is well marked, and it can be easily distinguished. Sand or quartz-rock pulverized or granulated is alluvium, separated from the drift by the waves and currents of the ocean, and elevated by the action of the winds and waves. The deltas or rich interval lands near the outlets of rivers are alluvium and are formed by the subsoiling of the finer particles brought down by the current of the stream. The mud found in the narrow bogs and creeks near the seashore is of the same character. Salt and fresh meadows, formed partly by such deposits of mud and partly by decayed vegetable and animal matter, belong to the same class. Peat differs from marsh mud only in the fact that one is formed in fresh water and the other in salt water. There are two, if not three, distinct varieties of peat; but all peat and all mud, whether fresh or originally salt, seem to have the same influence on the growth of the cranberry, and may be regarded as practically the same.

PREPARATION OF THE LAND.

The best soil for the cranberry is beach or quartz-sand, overlaid by about a foot of turfy peat. In preparing such bogs, all that is needed is to subsoil the same, bringing about 3 inches of sand to the surface. Underlying the deeper peats, the sand has become indurated, but on exposure to the air crumbles like meal or lime, and may be a useful top dressing. If the peat is deep and covered with rushes, wild grasses, or bushes, the whole must be pared over down to the bottom of the roots and removed, and the bog covered with beach or quartz-sand from 5 to 15 inches in depth.

On rich interval lands the same precautions must be used. If a thick coating of sand is not first spread over, it will be difficult to keep out the wild grasses, and if not kept out, the cranberry vines will, as on the deep peats, make too much wood and be unproductive. Some interval lands are naturally adapted to the growth of the cranberry. Such are usually found near the sources of streams or on the borders of rapid rivers. They contain much sand and fine gravel, and are easily brought into cultivation.

In preparing the land the object is to afford to the plant the elements needed for its successful growth, to give it entire possession of the ground, and to protect the young plants until they attain full vigor, when they are able to maintain themselves in health without further attention.

DITCHING.

Where savanna lands have been "turfed," the sod or turf is placed in a wall or embankment from 4 to 6 feet wide and of a height equal to the width. The ground is then plowed, the roots and stumps being removed or burned, when the land is ready for planting. Ditches must be made around the lot inside the walls, with cross ditches at distances varying from 100 to 300 feet, and of a depth (6 to 12 inches) depending on the character of the land, so that it may be flooded in winter and in summer and rapidly drained, provided there is not a permanent stream of water, which this kind of land seldom has. The black land is treated in much the same manner, except that it is usually found on the banks of, and contiguous to, a stream of water by which it may be flooded, and in this fact, and probably in the greater quantity of muck over the sand, its superiority over the savanna land mainly consists.

There are many abandoned mill ponds which are readily available for cranberry parks at comparatively small expense, and are much sought, as the dams are already erected and water is abundant.

The kind of land that has the deep muck bottom of cedar or other swamps is by far the most expensive kind of ground to prepare, yet when properly prepared it is the most valuable, because of the larger and more certain product, as well as of its more permanent fertility. In moist seasons the sand or savanna ground yields generous crops, but in very dry seasons the amount of fruit is much reduced.

PREPARING SWAMP LANDS.

The swamps are usually covered with cedars, bushes and stumps, and, as they are wet, require thorough drainage, and, being soft and miry, the labor on them is difficult and tedious. When these incumbrances are removed, the whole surface must be covered with a coating of 4 to 8 inches of sand. The sand is taken from the shores where it usually abounds and scattered over the muck, when, if properly drained and ditched, it is ready for the vines. The sand is essential, for, while the

vines will grow luxuriantly on the muck, so will the weeds and grass, and the vines would be smothered and choked. The silex is a necessary ingredient for the health of the plant. Pure white sand is also essential. Clay, or even a loamy sand, is inimical to the cranberry and should be studiously avoided.

A good test for the proper sand or gravel to be used is this: Take a portion of the soil and compress it tightly in the hand; if it is suitable it will fall apart upon being released; but if composed in part of loam, it will adhere together after the pressure is removed, thus indicating its unsuitability.

The cost of preparing and planting varies with the character of the ground. The savanna, which requires simply "turfig," when it is ready for the plow and then for planting, is the least expensive, and, it may also be remarked, the least valuable.

The depth of sand required to be spread on the surface depends upon the depth of the peat. If the latter is only a foot or two in thickness, 5 inches of sand is considered sufficient; if it is several feet thick, at least a foot of sand is required to make a good bog. The more sand there is used, the longer it requires to bring the vine into a bearing state.

Much stress is placed on the quality of sand by all cranberry growers. It is claimed that coarse, clean, sharp sand is best adapted to the growth of the vines. In some cases only an inch of sand is placed over the peat bottom, and then it is planted with vines, the roots growing directly in the muck. In other cases as much as 10 inches of sand has been placed over the muck sand, which, however, conveys the soluble humus of the peat to the roots of the plants. There is always a rankness of root and vine growth when the vines are planted directly in peat, and, as the growth of plants is continued longer under such conditions, they are longer in bearing their fruit. The same remarks apply to plants which are heavily manured and constantly supplied with abundance of water.

It has been found in every case where the runners have been sanded to the depth of about an inch and properly watered they readily take root in the fresh sand and produce a fine growth of lateral branches. In some cases sanding the vines in this way has as good an effect on their growth as an application of guano. It is believed by many successful cranberry growers that the runners of the vines should be sanded at least once in four years when practicable, and some growers sand them as often as once in three years. The great advantage derived from the sanding process consists in the stimulating of new roots along all the runners embedded in the sand. The original roots decay as the vigor of the new ones increases, but the sand also protects the runners from extreme heat and premature frost.

The true character of peat in relation to cranberry growth is still a matter of doubt; but one thing is evident, namely, that masses of peat will always absorb and retain a large amount of water, and will thus

tend to keep moist the sand on the top. Certainly the humus of the peat is not itself absorbed by the roots of plants, but humic acid seldom is free from ammonia, and the oxidation of peaty matter may also contribute to root and plant growth by supplying carbonic acid, which is one of the essentials of plant food.

CULTURE.

VARIOUS METHODS OF PLANTING.

In planting cranberry vines several modes have been followed.

Sod-planting, by taking from their native marshes sods containing cranberry vines, moss, turf, etc., and placing them on prepared or unprepared meadows, was formerly practiced, but is now discarded.

Hill-planting, with bunches of clean vines, in drills 2 feet apart each way, and a handful of vines planted at each intersection, is practiced; but large bunches have a tendency to dry up and become woody, thus injuring the plantation.

In drills requiring no sanding, but susceptible of being prepared with a plow, the best method is to "strike out" the ground with a plow, in rows 3 feet apart, and scatter the vines thinly and evenly along the furrows, putting only 1 or 2 in a place. They should be inclined against the "land side," projecting 4 or 5 inches above the surface, after which the hoe is required to fill up the furrows and thoroughly cover the roots. This causes them to sucker and grow more luxuriantly than when left standing upright, to be swayed by the winds.

On soils properly prepared by spreading sand over muck or peat, the best mode is to mark out the ground 14 inches apart with a small sled having three runners; the vines are then dropped in these marks, say 2 in a place, 14 inches apart in the rows, and pressed into the ground with a spade-like tool placed on the vine, about one-quarter the distance from the root to the top. The roots of the vine should be pressed into close proximity to the muck below, that they may be stimulated to grow more rapidly.

Spreading the vines evenly over the surface of the meadow, and then covering them about an inch deep with sand, has succeeded well in New Jersey. The young shoots come up through the sand as thick as wheat, making an excellent growth, and the whole surface is soon matted with them. This mode requires more vines than the others, but yields a crop sooner than by planting in any other way.

Sowing by cuttings can be successfully done, the vines being passed through a straw-cutter, and chopped into pieces about an inch long; they are then sown like oats upon evenly prepared surfaces and harrowed in. This must be done early in the spring and upon moist ground, so that the cuttings will become well rooted before the heat of summer.

Attempts have been made to grow them from seeds, but owing to the longer time required for the vines to become productive and the increased expense of keeping them clean this system has been abandoned for general culture.

DRAINAGE.

Great care should be taken in selecting the vines to procure those which yield large berries. The shape of the fruit is of little consequence, the great desideratum being to obtain berries of good size and color. Until the vines are well matted it is important to keep the meadow thoroughly drained at least one foot below the surface. It will generally be found necessary to go deeper than that to effect a thorough drainage, without which the vines will not thrive. Even if planted on ground well adapted to their growth, if the meadow is allowed to remain very wet the vines will make little or no growth. When properly drained a good meadow will become matted in three years, although some of the most permanent plantations have required a longer time to come into full bearing, owing to the dampness of the soil.

TIME OF SETTING AND SUBSEQUENT TREATMENT.

The cranberry vine is very tenacious of life, and will grow if set at almost any season, but the spring of the year is usually considered the best time, and as early in spring as possible, to secure a good growth.

Though various methods of treatment for the second and third years have been pursued, experience has demonstrated that the simplest mode is the best. The hoe is rarely needed to eradicate weeds and grass, and its use, or that of the plow and cultivator used by some, is injurious. The weeds and grass are best eradicated by hand-pulling, which prevents injury to the roots and tender running vines. The hoe may be used to level the surface and make drains from low spots so that there shall be no stagnant water. Sluices should be made to carry the water off rapidly after the flooding or after heavy rains.

FLOODING THE VINES.

The usual time for flooding is from the last of October to the first of May, and 18 to 24 inches of water are sufficient.

Some cultivators advise a flow of water for twenty-four hours in the first week in June, when it can be done rapidly and safely. The water is then drained off and the plants, under the genial influences of the sun and moisture, are soon covered with tiny pink-white blossoms and the fruit quickly appears. All that is now needed is to keep a supply of moisture during the drought of summer, till the harvest calls for more active operations.

A flood gate is a very important item in cranberry culture. In many places, such as on level and high lands, a cheap mode of ditching and

a very inexpensive gate formed of a few slabs are all that is necessary. In some cases nature provides all the requisites. Flooding protects the vines from winter frosts, and is one of the means employed to destroy mice, roaches, grasshoppers, and a variety of insects which consume or destroy many thousand bushels of berries annually. Ice is sometimes very destructive to vines when proper attention is not paid to winter flooding. Should a severe frost set in before the vines are wholly covered with water ice will form on the surface, thus securing the tops in ice; a further supply of water flowing under the ice may float it upward and drag the vines from their roots.

It should be remarked that the continued success of a cranberry field depends very greatly on the readiness with which water can be admitted upon the surface or withdrawn from it.

At Cape Cod, Mass., the cranberry cultivators take advantage of the winter and sand their vines while covered with ice. They cart the sand over the ice and spread it evenly over the surface. When it melts the sand is deposited over the vines. This practice is not only economical, but it also saves the vines from being trampled upon.

CRANBERRY FERTILIZERS.

Cultivators of the cranberry are divided in opinion on the subject of fertilizers, as to their use in any case, as well as to the kind, quality, and quantity to be used, and whether in the spring or in the fall. Some have used guano to great advantage. One application on heavy soil showed evidence of its value for several years afterwards. It is used as follows: Two quarts of guano, combined with one pail of moist sand, is spread on the soil at such a rate that from 50 to 250 pounds of guano will be required on each acre. Guano and bone dust have been used to the advantage of growth of vines and size of berries, but it has no visible influence in preventing rot or scald. On high land savannas, in dry seasons, guano may prove injurious, in consequence of its free ammonia, which acts as a caustic on the roots, while in seasons of light rains it will prove of great advantage.

Excessive fertilization produces a rank crop of vines and frequently of the fruit. The perfect growth of berries can be attained only by the production of light wood on vines. The continued growth of succulent vines, caused by overfertilization, deprives the berries of material which should be used for their growth and perfection toward the ripening season.

GATHERING THE CROP.

The month of October is the proper season for gathering the crop. The berries are sometimes gathered by means of a rake, called the cranberry rake, but the finest and most valuable berries are those gathered by hand, as are strawberries.

Cranberries free from spots and carefully handled to prevent bruising will keep well in places suitable for storing apples or other fruit, with as low a temperature as possible to avoid freezing. Thorough ventilation is also very essential.

When gathered under a high temperature they should be placed under shade in open trays to cool.

Previous to shipping cranberries they should be run over a platform slightly inclined. The rotten and bruised fruit will not run off, but will stick on the platform, and may be scraped off and thrown away.

SOLAR HEAT.

Dr. Taylor says:

It is generally supposed that the cranberry plant will not grow successfully farther south than southern New Jersey. This belief is based upon the fact that a large portion of the crop is destroyed by excessive high temperatures, but when we find in those favored cranberry lands 10 acres of successful vines and berries side by side with as many acres rotting and scalding, under the same climatic conditions, we come to the conclusion that if the solar rays were directly the cause of rot all would suffer alike, as it is well known that many bogs for a period of from ten to twenty years have successfully grown fruit free from rot. High temperatures, therefore, can not be the general cause of rot. Indeed, it seems to perfect the fruit when the soil and rains are highly favorable. What is wanted is a rich soil, a constantly moving moisture or water at the roots, and a sufficiently high temperature. Springy land has been found to be very favorable to the growth of sound vines and berries. I am convinced that in the District of Columbia and in the States of Maryland and Virginia there are many patches of bog lands suitable for cranberry culture, which are of little or no value at present.

We have sometimes been called upon to explain why it is that on the same branch or vine sound and rotten berries will frequently grow side by side. It is a well-known fact that the whole vine does not blossom at the same time. There is a first and second bloom on the same pedicel. Berries form on the same stalk which bears the blossom for a second and third berry. The first bloom and berry may get its first start with rain and sunshine sufficient to bring it to perfection, while the second bloom and fruit may be deprived of this favorable start.

COLORING WILD BERRIES.

It is the custom of the West Jersey Land Company to gather the wild berries while green. An open shed is prepared, under which the berries are placed on the bare ground, spread evenly, and exposed day and night from six to eight weeks to color. Berries have been colored to a high red by this process and perfectly free from rot. The cultivated berries are not exposed in this way, but are first cooled, cleaned, and freed from all unhealthy berries by hand picking or machinery.

INJURIOUS INSECTS.

There are drawbacks to the results and enemies to the vine and fruit to be resisted, as with almost all other fruits. The cranberry has suffered both in fruit and vine from the ravages of insects, sometimes to the extent of a total denuding of the vines of their leaves and the loss of entire crops. It is to protect the vines and fruit against these,

as well as against the effect of frost upon the unripe berries, that flooding is regarded as necessary by experienced growers.

There are a number of insects preying on the cranberry, the more important of which are the black-headed worm, the yellow-headed worm, the fruit worm, and the tip-worm.

THE BLACK-HEADED WORM.

The black-headed worm (*Rhopobota vacciniana*), also called vine worm or fire worm, is the larva of a moth. It does not fly very readily in the daytime, but may be found starting up occasionally. There are two broods each year. The eggs retain their vitality during the winter and hatch early in May. The larvæ eat the leaves, spinning them into a web at the same time. The larva is a small, slender, velvety-green caterpillar, with a black head. The second brood appear about the time of blooming and are more destructive than the first. They web more leaves together and bite the leaves just enough to kill them and destroy all the flowers. In two or three days they can change a bog from green to brown.

THE YELLOW-HEADED WORM.

The yellow-headed worm (*Teras vaccinivorana*) is somewhat like the above in that the larvæ spin webs and are green in color, but they have yellow heads. The moths are orange in summer and slate gray in autumn. The gray ones spend the winter on vines and under rubbish. The eggs are laid early in spring and hatch in May. The caterpillar changes into an orange-colored moth in about a month. There are usually three broods each season, the last being the gray moth, the larvæ of which are reddish in color.

If the water supply can be controlled, drawing off the water early and flooding for two days just after eggs of the first brood begin to hatch will kill most of them. Flooding until late in the spring is also beneficial. Pyrethrum, dry and in infusion, has been tried with favorable results. White hellebore is good. Tobacco decoction, 1½ pounds to a gallon of water, gives sufficient return to more than pay for itself. Kerosene emulsion as a spray applied to the vines was tried quite effectively, as were also Paris green and London purple (1 pound to 150 gallons of water) sprayed over the plants just after the larvæ were hatched. If they begin webbing, use kerosene emulsion.

THE FRUIT WORM.

The fruit worm (*Acrobasis vaccinii*) is the larva of a gray moth. It shades to nearly black and is spotted with white. The eggs are laid on the berry when just forming. They hatch in five or six days and soon eat their way into the fruit, closing the opening with a web of fine

silk. After attaining about half their growth they seek another berry and so on until they mature. The larva is about half an inch long, green tinged with red, and reaches maturity in September. Spraying the vines with Paris green or London purple just after the fall of the flowers is an effective remedy.

THE TIP-WORM.

The tip-worm (*Cecidomyia vaccinii*) eats out the terminal bud, causing laterals to come out. It stunts the plant for a short time, but is not generally considered troublesome.

A minute scale insect has been found abundant in some bogs.

FUNGIOUS DISEASES.

CRANBERRY SCALD.

Cranberry scald is a fungous disease well known to cranberry-growers, often causing a loss of half the crop. It receives its name from the scalded appearance of the affected berry.

At first a portion of the berry becomes soft and the skin tense and of a reddish brown color. Sometimes only a portion of the berry decays and the spores of the fungus may be seen in the minute dark specks. A rank growth of fungus filaments is always associated with the scald. The same filaments are to be found in the roots, stems, and leaves of the affected plants, and similar pustules develop on the leaves and fruit. Various fungicides have been tried without obtaining any very satisfactory results. However, it has been learned that covering the bog with a layer an inch deep of fresh earth, clay, or sand will nearly always give relief from the scald. This can best be done when the bog is flooded. This treatment may be too expensive to pay. This disease seems to be due to conditions of the soil and water, and these must be looked after if anything is to be done with the scald.

Investigations made in 1874, by Dr. Thomas Taylor, Microscopist of the Department, proved that the rot of the cranberry is caused by the fermenting of the muck and the stagnating water in which they are grown, and sometimes by the scorching sun. Previous to this growers had given no attention to the condition of the roots of the vines or to the soil in which they grew. His observations proved that the rot was confined to the parts indicating fermenting soil, while the sound berries grew on the well-decomposed soil.

He visited many places in New Jersey and Massachusetts in company with several practical cranberry growers. Of one plantation visited he says:

The vines on this plantation rotted in spots last season. An examination of these spots showed undecomposed peat and unhealthy roots, the latter being very large and closely matted. Having stated to the cranberry growers accompanying me that fermenting soil and stagnating water were probably the principal causes of the

rot, I was informed that, although my theory held good thus far, there was a neglected cranberry plantation near Bricksburg, the water of which they believed to be stagnant, as it had no visible outlet; but notwithstanding, the fruit of the bog had not been affected by the disease. An examination showed that the water which flooded it was perfectly fresh, being supplied probably by means of springs, and passed off through the sand. The whole surface was covered with a dense growth of moss and weeds interspersed with cranberry plants. The cranberry roots were growing in the moss and confined to it. They were short, of a whitish color, and very healthy. Sand to the depth of 8 inches had at one time been spread over the peat muck. I cut through it and found it to be very pure and free from any odor. I have also examined the roots of the cranberry plants as found growing in the wild state, and in all cases have found them to be healthy and similar to these. I have thus far failed to discover any healthy cranberry vines growing in stagnant water.

He further says:

Two specimens of vines, one healthy and the other unhealthy, were received by the Department, and a specimen of the soil in which each plant grew. An examination of the roots of each vine showed that the one which bore rotting fruit had much larger and darker roots than the other. The peaty muck in which the healthy plants grew has a pleasant odor, and was not in a fermenting condition, while that of the unhealthy plant was in a condition of fermentation and had the odor of sulphureted hydrogen. These facts led me to believe that the sour condition of the soil was the primary cause of the rotting of the berries.

Before investing in cranberry culture—

he continues—

attention should be paid to the condition of the soil; for on that depends the quantity of water necessarily required for the purposes of irrigation. When water is very limited in supply it should be protected from the sun's rays in some practical way. Small dams or ponds, used as reservoirs, might be protected by shade trees, and in many cases streams might be easily protected in this way. A limited supply of water during high temperatures, when the water becomes quickly heated, is hurtful to the vines, especially when the subsoil has not been well decomposed. Under such conditions fermentation will be promoted, producing organic acids and sulphureted hydrogen in the vicinity of the roots; while a much larger flow of water in the ditches would cool the substratum of the bogs and remove at the same time all soluble noxious substances.

Recent observations demonstrate that dense fermenting muck may be greatly improved by the use of caustic lime and a bountiful supply of water. The lime reduces the consistency of solid peat and the running water removes the useless salts of lime which form during the fermentation and oxidation of the mass. The peaty matter, in the course of two or three years, is rendered very porous and free from all bad odors. As much as 100 bushels of lime to the acre have been used to advantage on heavy muck lands.

CRANBERRY GALL FUNGUS (*SYNCHYTRIUM VACCINII*).

This disease, although very local in New Jersey, threatens the extinction of the plant in some places. It produces minute cup-shaped, bright red outgrowths upon the leaves, stems, flowers, and fruit, and so robs the plant of vitality as to render it worthless. It also attacks the azaleas, huckleberry, wintergreen, and similar plants on the edge of the bog, which are reached by the water at high flood. It is thought that the disease spreads by the water carrying the infection. If the

water supply can be controlled, the withholding of water during the winter and spring has been attended with good results. Where such conditions are wanting, burning the bog is the only means of relief known.

OTHER PESTS.

GRASSHOPPERS.

At the second annual convention of the New Jersey Cranberry Association Dr. Taylor speaks of drawings, exhibited by Mr. E. Z. Collins, of Waterford, Camden County, of—

a very simple combination of spars, canvas, and sheet-tin trays, for the destruction of grasshoppers. The spars combined represent the Roman letter A, along the sides of which the trays and canvas are secured. The canvas is stretched perpendicularly, extending upward about 2 feet and downward about one foot, touching the top of the vines when in use. The operator walks with the frame, which is strapped over his shoulder. The trays are filled with tar and the canvas is smeared with it. When the person moves along with the framework the grasshoppers are thrown on the tar and secured. From one peck to a half bushel may be destroyed in this way each day. Crickets are not caught by this device. I am informed that mice and crickets eat the berries, while grasshoppers eat the seeds. Many thousands of bushels of fruit are destroyed annually by these pests.

MOSS.

Moss, *polytrichum commune*, which sometimes infests bogs, is objectionable in that it lifts the runners, and prevents them from rooting in the soil. The best way of disposing of moss is to cover it with an inch or two of sand. This remedy may be applied even after the vines are over two years old; the runners should be covered, and the upright branches, if possible, left out. The vines, thus established, will put forth runners and take possession of the clean surface.